



Anti-Theft Shocking Door Handle

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Client: Dr. Hess

Design Objectives

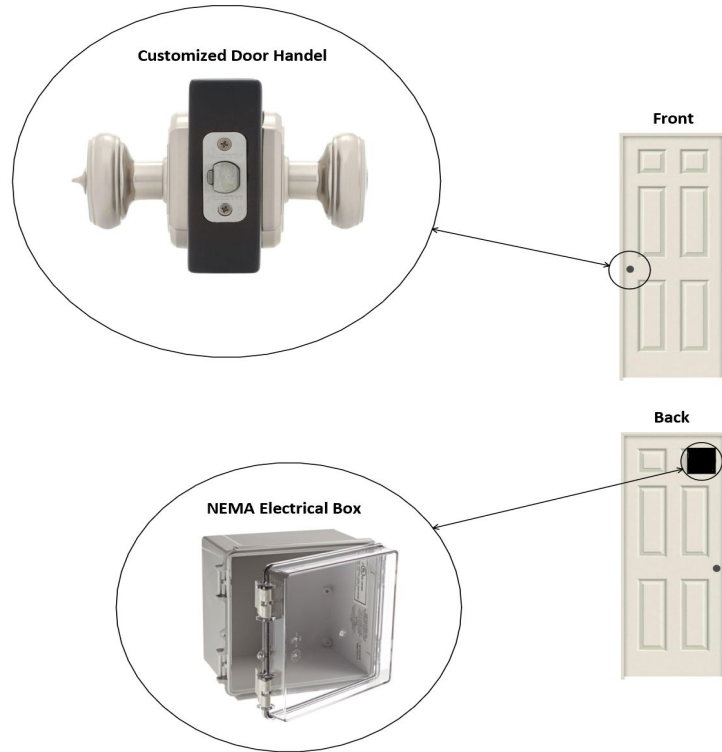
- Theft deterrence via electrical shock
- 4 Hz switching
- Remote power ON/OFF
- Testing and measuring outputs

Design 1 Overview



- Jacob's ladder
 - Generates electrical arcs from bottom up.
- Uses extremely high voltages
 - The busses would need to be mounted to hinges

Design 2 Overview



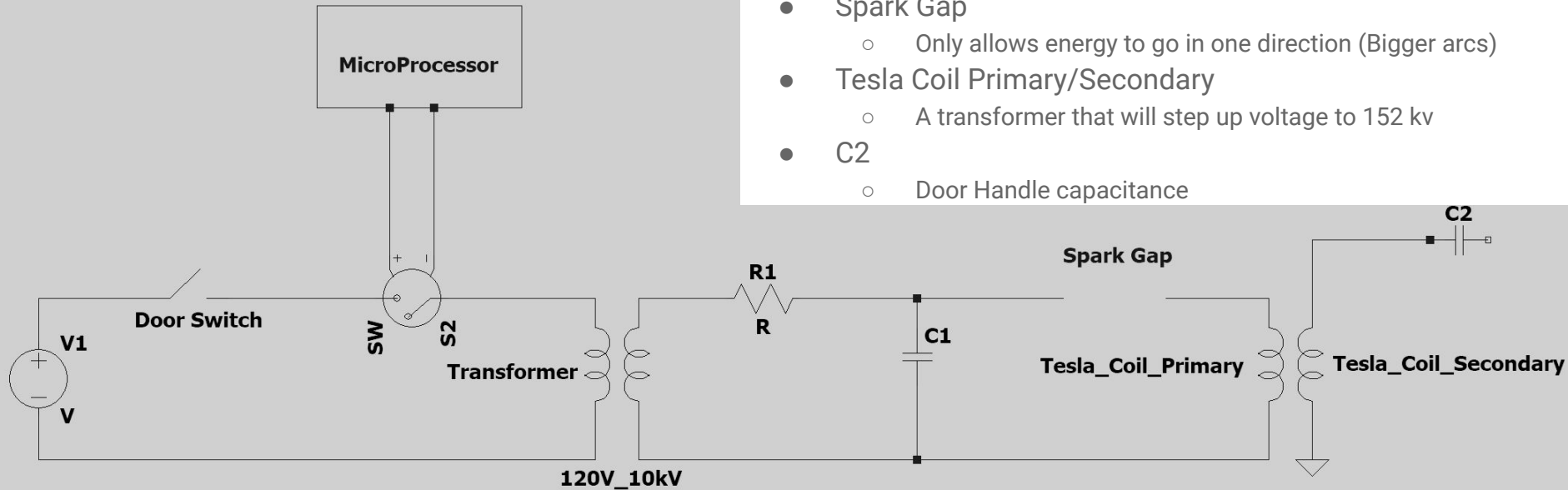
- Tesla coil used to generate voltage for arcing
 - Mounted inside NEMA electrical box
- Customized Door Handle for directing arc direction.
 - Only the outside handle will produce an arc
- Microprocessor and Infrared sensors
 - For motion sensing and switching control

Design Decision Matrix

Engineering Decision Matrix			
Criteria	Weight	Design 1	Design 2
Simplicity	0.15	5	6
Cost	0.25	7	7
Safety	0.5	2	8
Ease of use	0.1	5	10
Overall rating	1	0.4	0.765

Circuit Design

- Door switch
 - Opens the circuit when door opens
- S2
 - Switch controlled by a microprocessor (4 Hz)
- Transformer
 - Steps voltage up to 10kV
- R1
 - Variable resistance to adjust voltage levels
- C1
 - Capacitor Bank
- Spark Gap
 - Only allows energy to go in one direction (Bigger arcs)
- Tesla Coil Primary/Secondary
 - A transformer that will step up voltage to 152 kv
- C2
 - Door Handle capacitance

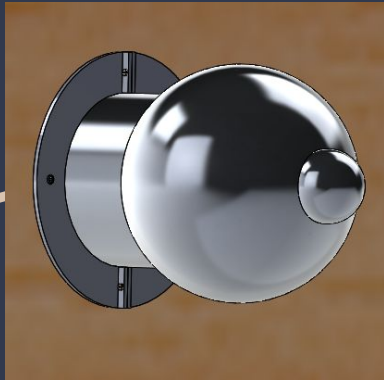


Heat Sink



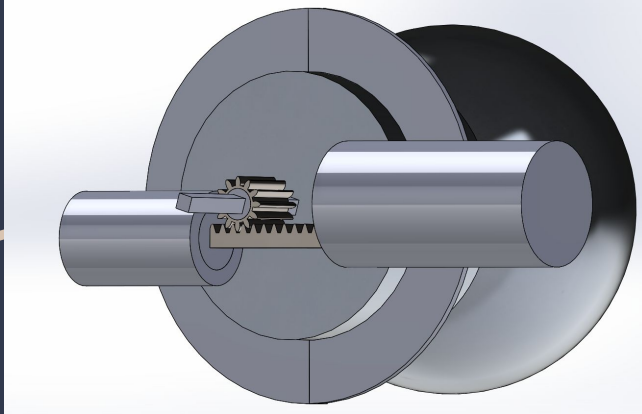
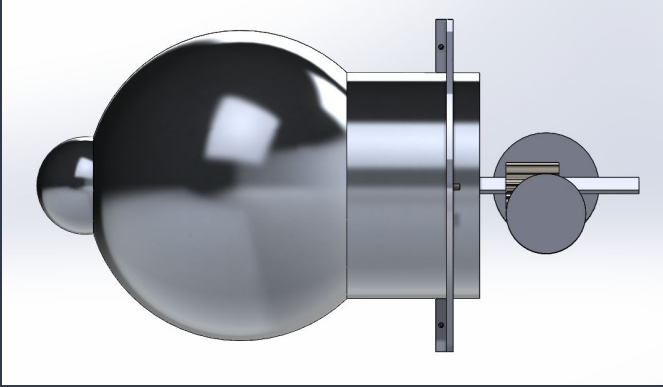
- To be mounted on the capacitor bank.
 - Amount of heat dissipation needed to be determined.
- Dependant on the capacitance C_1 .
 - Capacitance of the primary capacitor

Handle Design



- Designed to produce an arc from the tip
 - Aluminum 6061
- Rose Cover
 - Non-conductive material (3D printed plastic)
 - Fastened with non-conductive screws.

Door/Handle Design 1

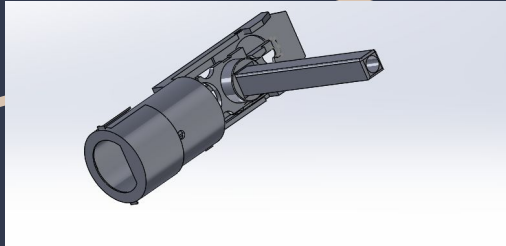


- Rack and pinion design
 - Gear Stock and Metal Rack
- Retract the Deadbolt linearly by an applied moment on the handle.
- Key to be interfaced with moldable rubber.

Door/Handle Design 2

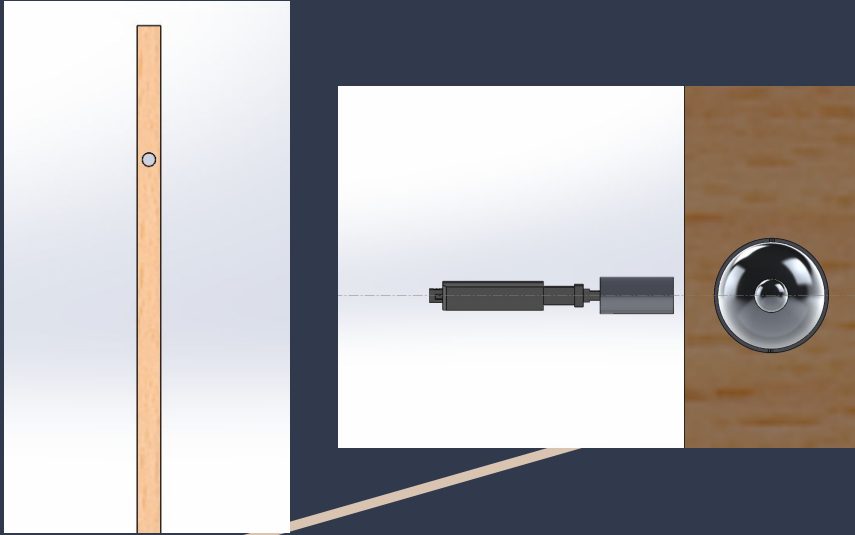


- Use existing door latch assembly to interface with door handle.



Door/Handle Design 3

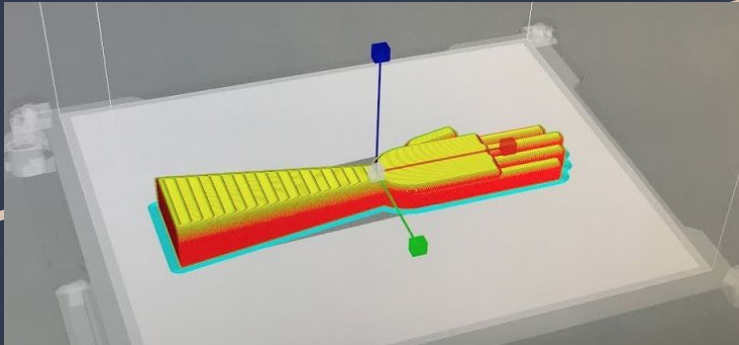
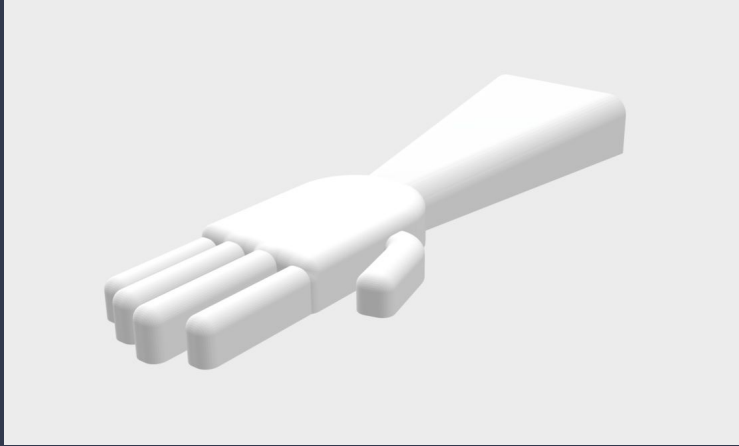
- Linear actuator to dead bolt
- Magnets to act as way to hold the door in place when not armed.



Door/Handle Decision Matrix

Engineering Decision Matrix				
Criteria	Weight	Design 1	Design 2	Design 3
Simplicity	0.15	3	5.5	9
Cost	0.15	3	10	6
Odds of Success	0.3	3	5	8
Ease of Use	0.4	5	7	9
Overall rating	1	0.38	0.6625	0.825

Testing



- 3D Print hand out of 3mm High Impact Polystyrene (HIPS)
- Material melting point = 240 degrees celsius
- Dimensions: X axis = 216.4386mm. Y axis = 70.1793mm. Z axis = 22.5mm.
- Silicone spray to replicate human skin

Budget

- Budget \$1000.00

Expense Items	Predicted Cost	Actual Cost
Sensor(s)	\$10.00	
Wire(s)	\$30.00	
Microprocessor	\$50.00	
Magnet Wire	\$35.00	
Power supply components	\$50.00	
ME misc supplies	\$75.00	
Motor	\$15.00	
Robotic Arm	\$20.00	
Misc EE components	\$10.00	
Plastic Tubing	\$12.00	
Metal Bar	\$125.00	
Door and frame	\$100.00	\$50.00
Insulation	\$60.00	
Led lights	\$20.00	
Insulated gloves	\$100.00	
Safety equipment	\$100.00	
Total:	\$812.00	\$50.00

Questions?

